

FEM 1259.125124/784

FLOOD INSURANCE STUDY



COUNTY OF LEE,
FLORIDA
UNINCORPORATED AREAS



NOVEMBER 3, 1969



Federal Emergency Management Agency

COMMUNITY NUMBER 125124

461w

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

This publication incorporates revisions to the original Flood Insurance Study. These revisions are presented in Section 9.0.

TABLE OF CONTENTS

	<u>Page</u>
1.0 <u>INTRODUCTION</u>	1
1.1 Purpose of Study	1
1.2 Authority and Acknowledgments	1
1.3 Coordination	1
2.0 <u>AREA STUDIED</u>	2
2.1 Scope of Study	2
2.2 Community Description	2
2.3 Principal Flood Problems	5
2.4 Flood Protection Measures	6
3.0 <u>ENGINEERING METHODS</u>	6
3.1 Hydrologic Analyses	8
3.2 Hydraulic Analyses	11
4.0 <u>FLOOD PLAIN MANAGEMENT APPLICATIONS</u>	22
4.1 Flood Boundaries	22
4.2 Floodways	23
5.0 <u>INSURANCE APPLICATION</u>	23
5.1 Reach Determinations	23
5.2 Flood Hazard Factors	24
5.3 Flood Insurance Zones	24
5.4 Flood Insurance Rate Map Description	25
6.0 <u>OTHER STUDIES</u>	25
7.0 <u>LOCATION OF DATA</u>	34
8.0 <u>REFERENCES AND BIBLIOGRAPHY</u>	34

TABLE OF CONTENTS (continued)

		<u>Page</u>
9.0	<u>REVISIONS DESCRIPTION</u>	37
9.1	First Revision (Revised November 3, 1989)	37
	a. Acknowledgments	37
	b. Scope	37
	c. Other Studies	37
	d. References and Bibliography	37

FIGURES

Figure	1	-	Vicinity Map	3
Figure	2	-	Historical Storm Tracks	7
Figure	3	-	Transect Location Map	18
Figure	4	-	Transect Schematic	22

TABLES

Table	1	-	Detailed Flooding Sources	4
Table	2	-	Summary of Discharges	9
Table	3	-	Parameter Values for Surge Elevations	10
Table	4	-	Summary of Stillwater Elevations	12
Table	5	-	Transect Locations, Stillwater Starting Elevations, and Initial Wave Crest Elevations	19
Table	6	-	Flood Insurance Zone Data	26
Table	7	-	Coastal Flood Insurance Zone Data	28

TABLE OF CONTENTS (continued)

EXHIBITS

Flood Profiles

Orange River	Panels 01P-02P
Daughtrey Creek	Panel 03P
Popash Creek	Panel 04P
Stroud Creek	Panel 05P
Owl Creek	Panel 06P
Telegraph Creek	Panel 07P
Hickey Creek	Panels 08P-09P
Billy Creek	Panel 10P

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY

LEE COUNTY, UNINCORPORATED AREAS, FLORIDA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Unincorporated Areas of Lee County, Florida, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Tetra Tech, Inc., in 1978, for the Federal Emergency Management Agency (FEMA), under Contract No. H-4059. This Flood Insurance Study was also prepared based on the coastal surge and wave height analyses data prepared by the South Florida Water Management District (SFWMD) (Reference 1).

1.3 Coordination

The following firms or agencies were contacted in an attempt to explore all possible sources of data: the Florida Department of Natural Resources, the Florida State Department of Community Affairs, the Florida State Department of Transportation, the Board of County Commissioners, Lee County, the Lee County Division of Transportation, the Lee County Flood Insurance Coordinator, the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), and the Southwest Florida Regional Planning Council.

Also contacted were the Southwest Florida Water Management District, the SFWMD, the U.S. Army Corps of Engineers (COE), Jacksonville District, the U.S. Geological Survey (USGS), Brevard Engineering, Gee and Jenson, Engineers, Architects, Planners, Inc., Howard Needles Tammen and Bergendoff, and Johnson Engineering.

The State Coordinator was involved in this study through the Atlanta FEMA Regional Office.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Lee County, Florida. The area of study is shown on the Vicinity Map (Figure 1). The incorporated areas within the county were excluded from this study.

Riverine areas studied by detailed methods were selected based upon the extent and validity of available existing hydrologic and hydraulic data. A list of the remaining flooding sources studied in detail and the limits of study are found in Table 1, Detailed Flooding Sources.

A detailed coastal flooding analysis was performed on the complete coastline of the unincorporated areas of Lee County, where the flooding sources are the Gulf of Mexico, Pine Island Sound, Charlotte Harbor, Matlacha Pass, San Carlos Bay, Estero Bay, and the Caloosahatchee River.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by FEMA and Lee County.

The area south of Lehigh Acres to Corkscrew Swamp along the eastern county boundary was studied by approximate methods.

2.2 Community Description

Lee County encompasses an area of 785 square miles in southwestern Florida and is bounded by the Gulf of Mexico to the west, Charlotte County to the north, Collier and Hendry Counties to the east, and Collier County to the south. According to the U.S. Bureau of the Census, the 1980 population of the county was 205,266 (Reference 2).

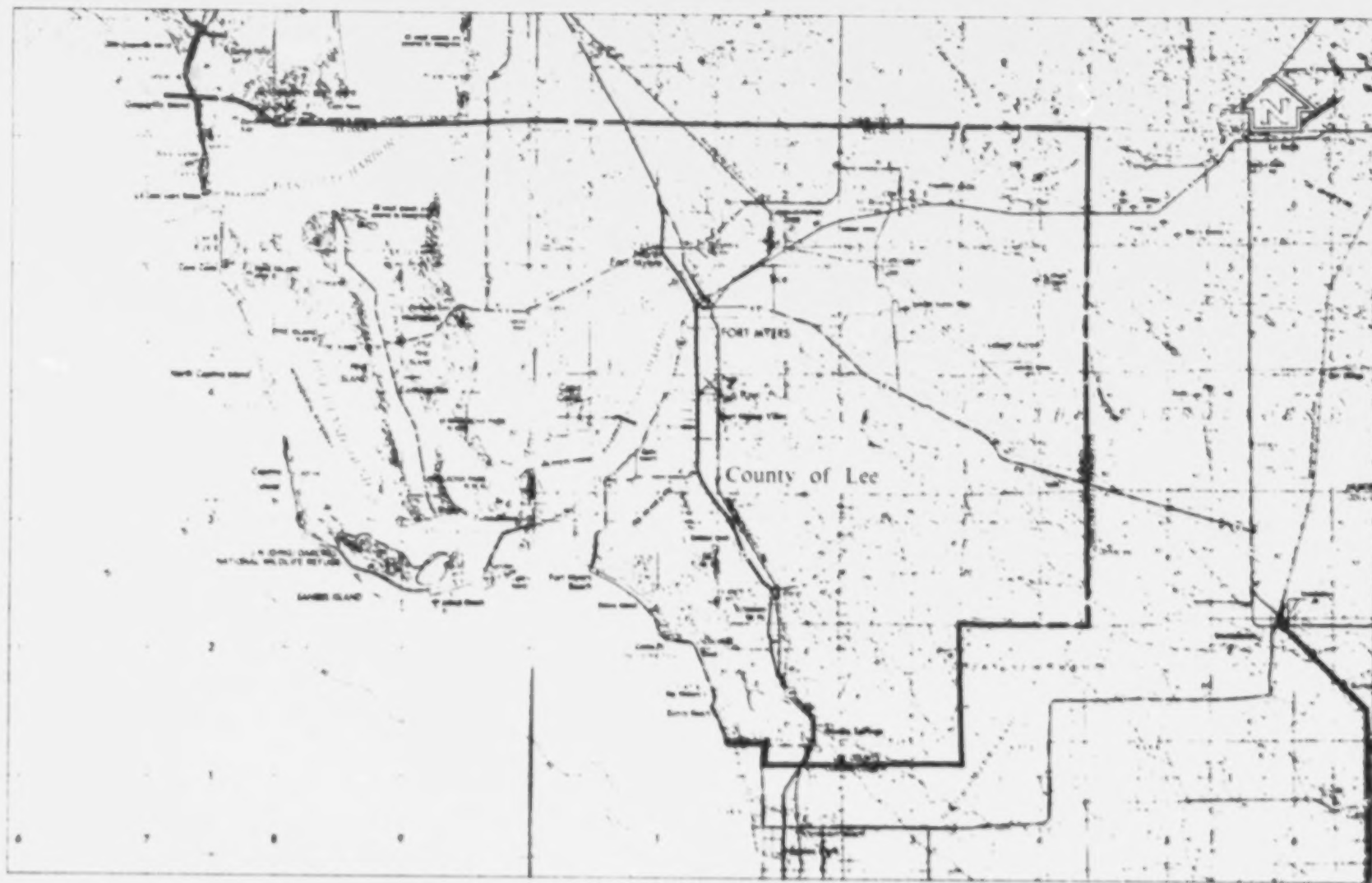


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

0 7 14 21 MILES

VICINITY MAP

TABLE 1 - DETAILED FLOODING SOURCES

DETAILED FLOODING SOURCESDESCRIPTION OF STUDY LIMITS

	<u>FROM</u>	<u>TO</u>
ORANGE RIVER	Mouth at the Caloosahatchee River	About 1.8 miles upstream of Buckingham Road
DAUGHTREY CREEK	Mouth at the Caloosahatchee River	Just downstream of Bright Road
POPASH CREEK	Mouth at the Caloosahatchee River	About 0.7 mile upstream of Leetang Drive
STROUD CREEK	Mouth at the Caloosahatchee River	About 1.0 mile upstream of Bayshore Road
OWL CREEK	Mouth at the Caloosahatchee River	About 600 feet upstream of State Road 31
TELEGRAPH CREEK	Mouth at the Caloosahatchee River	About 2.0 miles upstream of North River Road
HICKEY CREEK	Mouth at the Caloosahatchee River	About 0.5 mile upstream of Bateman Road
BILLY CREEK	Mouth at the Caloosahatchee River	About 750 feet upstream of Glenwood Avenue

Lee County lies in the subtropical climatic zone. The year in this region is divided into wet and dry seasons. The wet season extends from June through September and coincides with the hurricane season. During this 4-month period, the county receives nearly two-thirds of its annual precipitation. Due to the moderating effects of the Gulf of Mexico, the coastal regions of the county are warmer in winter and cooler in summer than the interior portions. The City of Fort Myers records an average annual temperature of 74 degrees Fahrenheit.

The topography of Lee County is generally low and flat. Elevations rise eastward to approximately 30 feet National Geodetic Vertical Datum of 1929 (NGVD), but much of the developed area is below 10 feet NGVD. A chain of low islands with numerous inlets and large expanses of water forms a barrier to the mainland.

Much of the interior of the county is characterized by swampy areas resulting from the flat topography and a lack of surface drainage. Corkscrew Swamp covers a large portion of the southern part of the county and supplies the Imperial River which drains into Fish Trap and Little Hickory Bays at Bonita Shores. The Caloosahatchee River watershed, located in the central area of the county, is the main surface drainage system.

2.3 Principal Flood Problems

Flooding in the coastal regions of the study area results primarily from hurricanes and tropical storms. Not all storms which pass close to the study area produce extremely high storm surges. Similarly, storms which produce extreme conditions in one area may not necessarily produce critical conditions in other parts of the study area. However, with the condition of high winds directed onshore, the storm surges produced can inundate the low coastal islands and flood the coastal areas behind them for some distance inland. Wave action which accompanies wind-generated storms can cause flooding, erosion, and structural damage, particularly on the offshore islands. The Caloosahatchee River is a broad estuary and, under certain conditions, storm surges generated at its mouth can intrude far upstream. The rainfall which usually accompanies hurricanes and tropical storms can aggravate the flood situation, particularly in areas where the secondary drainage system is poorly developed. Freshwater flooding was considered in the coastal zone, but it is not as significant as flooding caused by storm surge in terms of damaging effects. Inland freshwater flooding is significant in regions near streams and rivers. Because of the flatness of the terrain, most inland areas are characterized by shallow flooding during heavy rainfalls.

Storms passing Florida in the vicinity of Lee County have produced severe floods as well as structural damage. A brief description of several significant storms provide historic information to which coastal flood hazards and the projected flood depths can be compared (References 3 and 4).

The hurricane of September 11-21, 1850 was one of the most destructive events of the century in Florida. Damage from this storm was estimated at \$100 million statewide. High tides up to 17 feet above normal were reported at Fort Myers and Punta Rassa. The offshore islands of Sanibel and Captiva were inundated, with many homes being swept off their foundations. Flooding damage in the Fort Myers, Sarasota, and Bradenton areas was estimated at \$3 million.

The hurricane of September 4-21, 1947 entered the Florida coastline at Fort Lauderdale on September 17. As it moved across the peninsula, it maintained its full intensity and caused extensive flooding. Winds of 90 knots were recorded at Fort Myers, where storm damage totaled nearly \$1 million.

In September 1960, the southern portion of Lee County was particularly affected by Hurricane Donna. High-water marks of 10 to 11 feet NGVD were recorded on Estero Island. The effects of the hurricane were augmented by antecedent rains which, in the previous three weeks, totaled almost 10 inches over the affected areas. This resulted in higher-than-normal water tables.

Directions of several historical storms occurring in the vicinity of Lee County are shown in Figure 2, Historical Storm Tracks.

2.4 Flood Protection Measures

No extensive community flood protection projects exist along the coast. Flood proofing of structures is done on an individual basis and includes such measures as elevating dwellings, conservation of mangrove swamps and dunes, and construction of seawalls.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.



HISTORICAL STORM TRACKS (1871-1972)

FEDERAL EMERGENCY MANAGEMENT AGENCY.

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

FIGURE 2

3.1 Hydrologic Analyses

Analyses were carried out to establish the peak discharge-frequency and peak elevation-frequency relationships for each flooding source studied in detail affecting the community.

The riverine hydrologic analysis included a hydrologic budget based on the following factors: rainfall, infiltration, ground water levels, canal flow, evapotranspiration, and surface ponding.

Several sources of rainfall data were utilized for the inland as well as the combined coastal/inland portions of this study. A log-normal analysis has been applied to various interior and coastal locations in Florida and has been found to give reasonable results (Reference 5). The computed values of maximum long-duration rainfall obtained from such an analysis for one-to-four-day durations were matched with the values obtained from isohyet curves developed by the U.S. Weather Bureau (References 6 and 7). In addition, actual hourly rainfall data provided by the NOAA (Reference 8) was applied through watershed models to generate annual peak flows. The floods of the required frequencies were then formulated by performing a log-Pearson Type III analysis (Reference 9). These results were comparable with those obtained by using synthetic flood hydrographs.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each riverine flooding source studied in detail in the community are shown in Table 2, Summary of Discharges.

Inundation from the Gulf of Mexico caused by passage of storms (storm surge) was determined by the joint probability method (Reference 10). The storm populations were described by probability distributions of 5 parameters that influence surge heights. These were central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These characteristics were described statistically based on an analysis of observed storms in the vicinity of Lee County. Primary sources of data for this analysis were the National Weather Service (References 11 and 12), Cry (Reference 13), Ho, Schwerdt, and Goodyear (Reference 14), and the National Hurricane Research Project (Reference 15).

A summary of the parameters used for the area is presented in Table 3, Parameter Values for Surge Elevation.

For areas subject to flooding directly from the Gulf of Mexico, the FEMA standard storm surge model was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the 5 storm parameters defined previously). By performing such simulations for a large number of storms, each of known total probability, the frequency distribution of surge height can be established as a function of coastal location. These distributions incorporate the large-scale surge behavior, but do not include an analysis of the added effects associated with much finer scale wave phenomena, such as wave height or runup. As the final step in the calculations, the astronomic tide for the region is then statistically combined with the computed storm surge to yield recurrence intervals of total water level (Reference 16).

TABLE 2 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA</u>	<u>PEAK DISCHARGES (CFS)</u>			
	<u>SQ MILES</u>	<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
DAUGHTREY CREEK At mouth	15.1	955	3,126	3,516	4,448
POPASH CREEK At mouth	5.7	386	1,250	1,404	1,784
STROUD CREEK At mouth	6.6	470	1,542	1,733	2,203
OWL CREEK At mouth	18.2	783	2,766	3,188	4,217
ORANGE RIVER	At mouth	96.0	2,560	6,029	9,054
	At gaging station	83.5	2,403	5,755	8,603
TELEGRAPH CREEK At mouth	115.2	2,773	8,044	9,811	16,191
HICKEY CREEK At mouth	40.6	1,382	3,537	5,119	7,711
BILLY CREEK At mouth	4.9	558	1,955	2,177	2,717

CENTRAL PRESSURE DEPRESSION (MILLIBARS)	97.5	87.5	77.5	67.5	57.5	47.5	37.5	27.5	17.5
AVERAGE ASSIGNED PROBABILITIES*	0.020	0.023	0.035	0.055	0.070	0.105	0.142	0.230	0.320
STORM RADIUS TO MAXIMUM WINDS (NAUTICAL MILES)	15				30				
PROBABILITY	0.61				0.39				
FORWARD SPEED (KNOTS)	8			14		20			
PROBABILITIES: ENTERING ALONGSHORE EXITING	0.46 0.46 0.50			0.35 0.35 0.43		0.19 0.19 0.07			
DIRECTION OF STORM PATH (DEGREES FROM TRUE NORTH)	<u>ENTERING</u> 63 18		<u>ALONGSHORE</u> 333			<u>EXITING</u> 288 243			
PROBABILITY	0.29	0.27	0.21			0.19		0.04	
FREQUENCY OF STORM OCCURRENCE (STORMS/NAUTICAL MILE/YEAR)	0.00299								

*AVERAGE OF ENTERING ALONGSHORE, AND EXITING PROBABILITIES

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

PARAMETER VALUES FOR SURGE ELEVATIONS

The storm-surge elevations for the 10-, 50-, 100-, and 500-year floods have been determined for the Gulf of Mexico and are shown in Table 4, Summary of Stillwater Elevations. The analyses reported herein reflect the stillwater elevations due to tidal and wind setup effects and include the contributions from wave action effects.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of streams in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in detail.

Cross sections and data pertaining to structures along the streams analyzed were obtained by field survey. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles.

The channel roughness factors (Manning's "n") used in the computer program were estimated by field inspection and varied from 0.035 to 0.100 for the overbanks, and 0.010 to 0.050 for the channel.

Starting water-surface elevations for all streams studied in detail were taken from historical flood elevations of the Caloosahatchee River. Water-surface elevations for riverine floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 17).

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations shown on the profiles are, thus, considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shorelines.

The FEMA storm surge model was utilized to simulate the hydrodynamic behavior of the surge generated by the various synthetic storms. This model utilizes a grid pattern approximating the geographical features of the study area and the adjoining areas. Surges were computed utilizing grids of 5 nautical miles, 1 nautical mile, and 2,000 feet, depending on the resolution required.

FLOODING SOURCE AND LOCATION	TRANSECT	STILLWATER ELEVATIONS (FEET NGVD)			
		10% (10 YEAR)	2% (50 YEAR)	1% (100 YEAR)	0.2% (500 YEAR)
GULF OF MEXICO					
On Gasparilla Island between county boundary and Boca Grande	1	4.7	8.2	9.3	11.7
Between Boca Grande and south end of Gasparilla Island	2	4.4	7.8	9.1	11.4
From north end of Cayo Costa to the midpoint of the island along the coast	3	4.7	7.8	8.9	11.1
From midpoint of Cayo Costa to south end of the island	4	5.5	8.7	9.9	12.2
Entire shoreline of Captiva and North Captiva Islands	5,6,7	5.7	8.9	10.0	12.3
Between Captiva and Sanibel Island	8	5.3	N/A	10.3	N/A

ELEVATIONS SHOWN OCCUR AT SHORELINE

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

SUMMARY OF STILLWATER ELEVATIONS

GULF OF MEXICO

FLOODING SOURCE AND LOCATION	TRANSECT	STILLWATER ELEVATIONS (FEET NGVD)			
		10% (10-YEAR)	2% (50-YEAR)	1% (100-YEAR)	0.2% (500-YEAR)
CHARLOTTE HARBOR					
Between county boundary and Yucca Pen Creek	9a	3.6	N/A	7.7	N/A
From Yucca Pen Creek to Gator Slough Canal	9	3.5	N/A	7.5	N/A
From north end of Pine Island to Pineland along shoreline	10	4.0	N/A	7.0	N/A
PINE ISLAND SOUND					
Between Pineland and Maria Drive along the shoreline	11	4.1	N/A	7.7	N/A
Between Maria Drive and south end of Pine Island	12	4.3	N/A	7.7	N/A
Useppa Island, Bird Key	3a	3.5	N/A	7.3	N/A
Part Island	4a	3.5	N/A	7.3	N/A
MATLACHA PASS					
From Gator Slough Canal to Buzzard Bay	9b	3.4	N/A	7.5	N/A
Between north end of Pine Island and State Road 78	11a	4.8	N/A	7.5	N/A
Between State Road 78 and south end of Pine Island	11b	4.7	N/A	8.5	N/A

*ELEVATIONS SHOWN OCCUR AT SHORELINE

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

SUMMARY OF STILLWATER ELEVATIONS

CHARLOTTE HARBOR — PINE ISLAND SOUND — MATLACHA PASS

FLOODING SOURCE AND LOCATION	TRANSECT	STILLWATER ELEVATIONS (FEET NGVD)			
		10% (10 YEAR)	2% (50 YEAR)	1% (100 YEAR)	0.2% (500 YEAR)
SAN CARLOS BAY					
Between Punta Rassa and Bunch Beach	13	6.4	11.2	12.7	15.2
Between Bunch Beach and Bodwitch Point	14	6.6	11.0	12.5	15.3
GULF OF MEXICO					
Between Bodwitch Point and Cottage Avenue on Estero Island	15,16	6.1	10.9	12.5	15.5
Between Cottage Avenue on Estero Island and Big Carlos Pass	17,18,19	6.1	10.8	12.4	15.5
Between Big Carlos Pass and New Pass	20	5.3	11.0	12.9	16.0
Between New Pass and Big Hickory Pass	21	6.4	10.0	12.7	15.5

ELEVATIONS SHOWN OCCUR AT SHORELINE

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

SUMMARY OF STILLWATER ELEVATIONS

SAN CARLOS BAY — GULF OF MEXICO

FLOODING SOURCE AND LOCATION	TRANSECT	STILLWATER ELEVATION (FEET NGVD)			
		10% (10 YEAR)	2% (50 YEAR)	1% (100 YEAR)	0.2% (500 YEAR)
GULF OF MEXICO					
Between Big Hickory Pass and county boundary	22	6.0	10.1	12.5	14.4
About 5400 feet northwest of the intersection of Bonita Beach Road and Hickory Boulevard along the shoreline	22A	6.0	10.1	12.5	14.4
About 2400 feet northwest of the intersection of Bonita Beach Road and Hickory Boulevard along the shoreline	22B	6.0	10.1	12.5	14.4
About 1950 feet southeast of the intersection of Bonita Beach Road and Hickory Boulevard along the shoreline	22C	6.0	10.1	11.1	N/A
ESTERO BAY					
Between Hell Peckish Bay and Estero River along the shoreline	19	3.7	N/A	10.7	N/A
Between Estero River and Coconut Road along the shoreline	20	3.9	N/A	11.6	N/A

*ELEVATIONS SHOWN OCCUR AT SHORELINE

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

SUMMARY OF STILLWATER ELEVATIONS

GULF OF MEXICO—ESTERO BAY

FLOODING SOURCE AND LOCATION	TRANSECT	STILLWATER ELEVATION (FEET NGVD)			
		10% (10 YEAR)	2% (50 YEAR)	1% (100 YEAR)	0.2% (500 YEAR)
ESTERO BAY					
From Coconut Road to about 1 mile south of Spring Creek	21	4.0	N/A	11.5	N/A
From 1 mile south of Spring Creek to Imperial River	22	4.0	N/A	11.2	N/A
About 5400 feet northwest of the intersection of Bonita Beach Road and Hickory Boulevard along the shoreline	22A	4.0	N/A	10.4	N/A
About 2400 feet northwest of the intersection of Bonita Beach Road and Hickory Boulevard along the shoreline	22B	4.0	N/A	10.4	N/A
About 1950 feet southeast of the intersection of Bonita Beach Road and Hickory Boulevard along the shoreline	22C	4.0	N/A	10.4	N/A
CALOOSAHATCHEE RIVER					
From mouth to Beautiful Island	23	4.5	N/A	8.2	N/A

ELEVATIONS SHOWN OCCUR AT SHORELINE

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

**COUNTY OF LEE, FL
(UNINCORPORATED AREAS)**

SUMMARY OF STILLWATER ELEVATIONS

ESTERO BAY—CALOOSAHATCHEE RIVER

Underwater depths and land heights for the model grid systems were obtained from topographic-aerial photographs of Lee County (Reference 18) and from USGS topographic maps (Reference 19).

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in a report prepared by the National Academy of Sciences (Reference 20). This method is based on the following major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions, such as sand dunes, dikes and seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures prescribed in Reference 20. All dunes and structures were assumed to remain intact for purposes of this analysis. Local vegetation was also considered to be effective in reducing the wave heights for this study. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Wave heights were computed along transects (cross section lines) that were located along the coastal areas, as illustrated in Figure 3, Transect Location Map. The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at large intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 100-year flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the 3-foot breaking wave for determining the terminus of the V zone (area with velocity wave action) was also computed at each transect. Table 5 provides a listing of the transect locations and stillwater starting elevations, as well as initial wave crest elevations.

Figure 4 represents a sample transect that illustrates the relationship between the stillwater elevation, the wave crest elevation, the ground elevation profile, and the location of the A/V zone boundary.

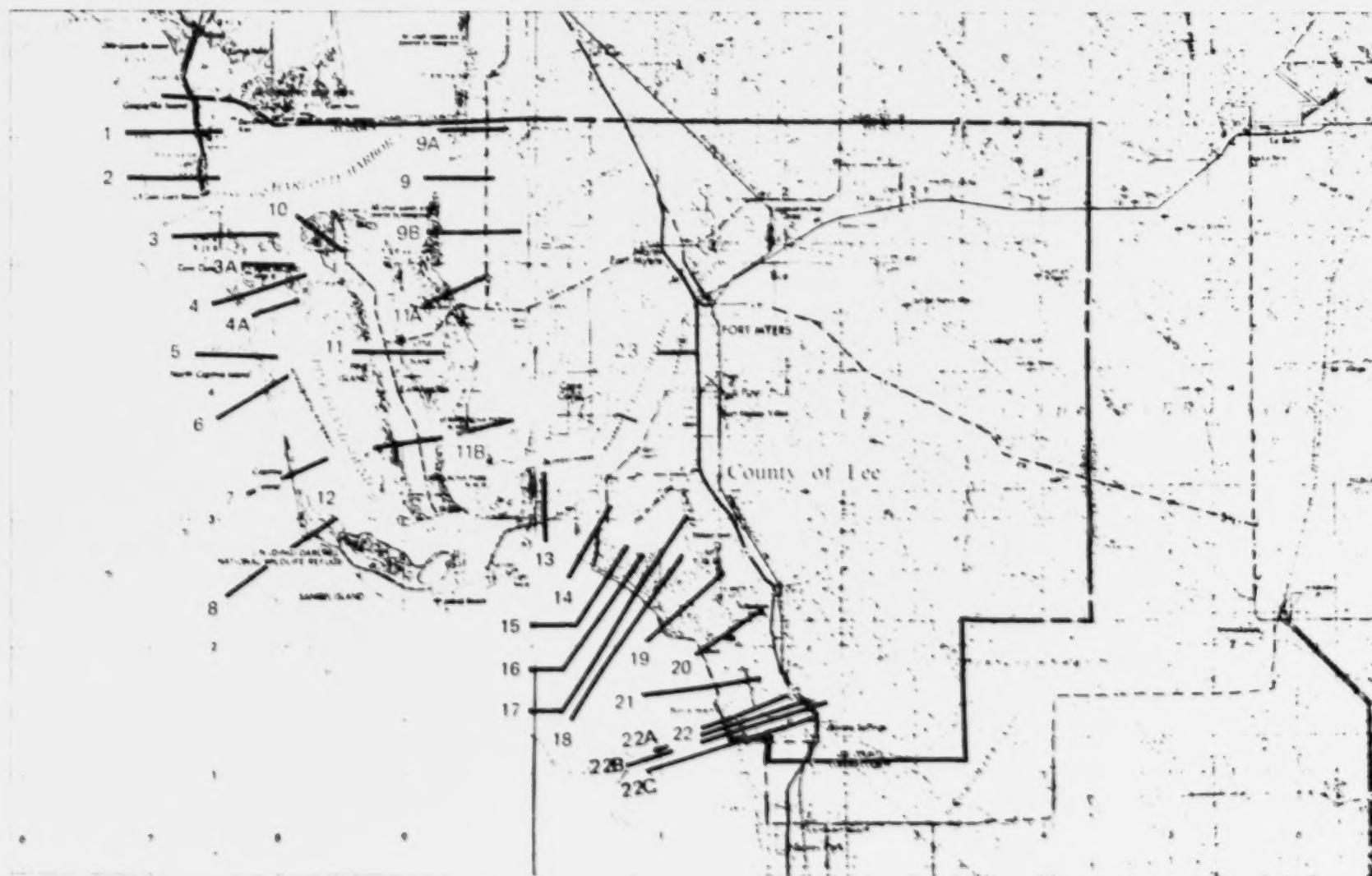


FIGURE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

TRANSECT LOCATION MAP

TABLE 5 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND INITIAL WAVE CREST ELEVATIONS

<u>Transect</u>	<u>Location</u>	<u>Elevation (Feet)</u>	
		<u>Stillwater</u>	<u>Wave Crest</u>
GULF OF MEXICO			
1	About 3.6 miles north of south end of Gasparilla Island	9.3	14.4
2	About 1.3 miles north of south end of Gasparilla Island	9.1	14.1
3	About 1.5 miles south of north end of Cayo Costa Island	8.9	13.8
4	About 2.3 miles north of south end of Cayo Costa Island	9.9	15.3
5	About 1,400 feet south of north end of North Captiva Island along the shoreline	10.0	15.4
6	About 1.9 miles north of south end of North Captiva Island along the shoreline	10.0	14.7
7	About 2.1 miles south of Redfish Pass on Captiva Island	10.0	14.8
8	On Sanibel Island near Blue Heron Way	11.3	17.4
CHARLOTTE HARBOR			
9	About 1.3 miles south of Yucca Pen Creek along the shoreline	7.5	11.2
9a	About 1.0 mile north of Yucca Pen Creek along the shoreline	7.7	11.6
10	About 1.7 miles west of Shell Pass along the shoreline of the north end of Pine Island	7.0	10.7

TABLE 5 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND INITIAL WAVE CREST ELEVATIONS
(Continued)

Transect	Location	Elevation (Feet)	
		Stillwater	Wave Crest
PINE ISLAND SOUND			
11	About 4,700 feet southeast of the intersection of State Road 78 and State Road 767 in Pine Island Center	7.7	11.6
12	About 2.4 miles north of Monroe Canal along the shoreline from the south end of Pine Island	7.7	11.6
3a	Useppa Island, Bird Key	7.3	9.4
4a	Part Island	7.3	10.0
SAN CARLOS BAY			
13	About 1.4 miles east of Punta Rassa along the shoreline	12.7	19.6
14	About 2,500 feet west of entrance to Pelican Bay along the shoreline	12.5	19.2
GULF OF MEXICO			
15	About 1.5 miles southeast of Bodwitch Point along the shoreline	12.5	19.3
16	About 2.3 miles southeast of Bodwitch Point along the shoreline	12.5	19.2
17	Along Fort Myers Beach at the intersection of Estero Boulevard and Gulf Island Drive	12.4	19.2
18	Along the shoreline of Estero Island at the intersection of Estero Boulevard and Avenida Pescadora	12.4	19.2

TABLE 5 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND INITIAL WAVE CREST ELEVATIONS
(Continued)

<u>Transect</u>	<u>Location</u>	<u>Elevation (Feet)</u>	
		<u>Stillwater</u>	<u>Wave Crest</u>
	GULF OF MEXICO (continued)		
19	Along the shoreline of Estero Island at the intersection of Estero Boulevard and Albatross Street	12.4	19.2
20	About 1 mile southeast of Big Carlos Pass along the shoreline	12.9	19.9
21	About 1,700 feet north of Big Hickory Pass along the shoreline	12.7	19.6
22	About 1.1 miles south of Big Hickory Pass along the Bonita Beach shoreline	12.5	19.3
	MATLACHA PASS		
9b	About 2.2 miles north of State Road 78 along the shoreline	7.5	9.9
11a	Just north of State Road 78 along the shoreline	7.5	10.1
11b	About 2.2 miles south of State Road 78 along the shoreline	8.5	11.0
	CALOOSAHATCHEE RIVER.		
23	From mouth to Beautiful Island	8.2	10.4

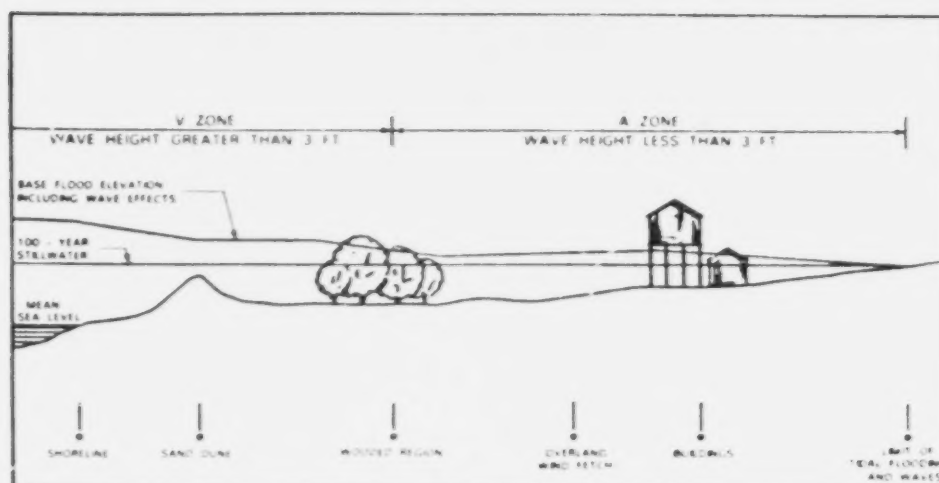


FIGURE 4 - Transect Schematic

After analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including topographic maps (Reference 19), aerial photographs (Reference 18), and engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects.

The shoreline is constantly changing along the coast of Lee County; therefore, the most recent aerial photos of the area have been used to depict the location of the shoreline (Reference 18). The area of Blind Pass between Captiva and Sanibel Islands is a dynamic inlet that opens and closes due to the passage of storms. For purposes of this Flood Insurance Study, Blind Pass is shown as an open inlet between the islands.

Elevations used in this study are referenced to the NGVD. Elevation reference marks used are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces flood boundary maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year

flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections the boundaries were interpolated using USGS topographic maps at a scale of 1:24000 with a contour interval of 5 feet (Reference 19). For each coastal flooding source studied in detail, the 100- and 500-year flood boundaries have been delineated using the flood elevations determined at each transect. Between transects, the boundaries were interpolated using aerial photogrammetric maps (Reference 18).

This 100-year and 500-year flood plain boundaries are shown on the Flood Insurance Rate Map. In cases where the 100- and 500-year flood boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods only the 100-year flood plain boundary was delineated using USGS maps at a scale of 1:24000 with a contour interval of 5 feet (Reference 19).

4.2 Floodways

The floodway is the channel of a stream plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. No floodways were computed for this study.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, the flood insurance zone designations for each flooding source studied in detail affecting Lee County.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard. In coastal areas, reaches are limited to the distance for which the 100-year flood elevation does not vary more than 1.0 foot. The locations of these reaches are shown on the Flood Insurance Rate Map.

For riverine studies, reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between
10- and 100-year Floods

Variation

Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of Lee County are shown on the Flood Profiles and summarized in Table 6, Flood Insurance Zone Data and Table 7, Coastal Flood Insurance Zone Data.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a riverine reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code.

The FHF for areas subject only to storm surge flooding is the difference between the 10- and 100-year stillwater elevations rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code. For areas with wave heights less than 3 feet, the FHF is the weighted average difference between the 100-year wave crest elevation and the 10-year stillwater elevation. For areas with wave heights greater than 3 feet, the FHF is determined using the difference between the 10- and 100-year stillwater elevations multiplied by 1.55, then rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code.

For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zones A3-A16:

Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.

Zones V8, V9, V11-V16,
V18, V20-22:

Special Flood Hazard Areas along coasts inundated by the 100-year flood that have additional velocity hazards associated with waves of 3-foot amplitude or greater; with base flood elevations shown, and zones subdivided according to FHF's.

Zone B:

Areas between Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas of less than 1 square mile. Zone B is not subdivided.

Zone C:

Areas of minimal flooding; not subdivided.

Flood elevation differences, PHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Table 6, Flood Insurance Zone Data and Table 7, Coastal Flood Insurance Zone Data.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Lee County is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water surface elevations of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

Two reports were published by the COE, Jacksonville District, with one covering northern Lee County and Charlotte Harbor, and the other covering southern Lee County (References 3 and 4).

Data presented in this study are in complete agreement with the Flood Insurance Studies in progress for the Cities of Sanibel, Cape Coral, and Fort Myers, Lee County, Florida (References 21, 22, and 23).

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
ORANGE RIVER REACH 1	0225,0250	-3.0	-1.1	1.8	030	A6	VARIES—SEE MAP
DAUGHTREY CREEK REACH 1	0225	-2.4	-0.3	0.6	025	A5	VARIES—SEE MAP
POPASH CREEK REACH 1	0225	-1.8	-0.3	0.5	020	A4	VARIES—SEE MAP
STROUD CREEK REACH 1	0225	-1.6	-0.3	0.2	015	A3	VARIES—SEE MAP
OWL CREEK REACH 1	0225	-2.6	-0.3	0.4	025	A5	VARIES—SEE MAP

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE

³ROUNDED TO NEAREST FOOT

TABLE 6	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOOD INSURANCE ZONE DATA
	COUNTY OF LEE, FL (UNINCORPORATED AREAS)	ORANGE RIVER — DAUGHTREY CREEK — POPASH CREEK — STROUD CREEK — OWL CREEK

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
TELEGRAPH CREEK							
REACH 1	0250	-4.4	-0.7	1.3	045	A9	VARIES—SEE MAP
HICKEY CREEK							
REACH 1	0250	-4.4	-0.9	1.6	045	A3	VARIES—SEE MAP
REACH 2	0250	-2.8	-1.0	0.9	030	A6	VARIES—SEE MAP
BILLY CREEK							
REACH 1	0225	-4.2	-1.3	1.2	040	A8	VARIES—SEE MAP
REACH 2	0225	-1.9	-0.7	0.6	020	A4	VARIES—SEE MAP

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE

³ROUNDED TO NEAREST FOOT

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

TELEGRAPH CREEK — HICKEY CREEK — BILLY CREEK

17

FLOODING SOURCE	TRANSECT	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 10% (100 YEAR) FLOOD AND 10% (10 YEAR)	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (FEET NGVD)
GULF OF MEXICO	1	0011,0013	-7.1	070	V14	11-13
			-5.7	055	A11	8-10
	2	0013,0126,0128	-7.3	075	V15	11-13
			-5.2	050	A10	8-10
	3	0128,0136,0138	-6.5	065	V13	11-14
			-4.7	045	A9	8-10
	4	0136,0138,0140, 0252	-6.8	070	V14	12-14
			-5.1	050	A10	7-11
	5,6	0252,0254,0262	-6.7	065	V13	12-14
			-5.2	050	A10	8-12
	7	0262,0264,0270 0381	-6.8	070	V14	12-15
			-5.6	055	A11	8-12
	8	0381	-7.8	080	V16	16

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE IN FEET

³ROUNDED TO NEAREST FOOT

⁴DUE TO MAP SCALE LIMITATIONS BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED

⁵INCLUDES EFFECTS OF WAVE ACTION

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

COASTAL FLOOD INSURANCE ZONE DATA

GULF OF MEXICO

28

FLOODING SOURCE	TRANSECT	PANEL ¹	ELEVATION DIFFERENCE ^{2,3} BETWEEN 10% (100 YEAR) FLOOD AND 10% (10 YEAR)	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ^{4,5} (FEET NGVD)
CHARLOTTE HARBOR	1	0011,0013,0015	-6.0	060	V12	10
	9	0160	-4.7	045	A9	8
	9a	0045,0160	-6.4	065	V13	10-12
			-4.8	050	A10	8-10
	10	0135,0140,0145	-4.6	045	V9	9-11
		0155,0165	-3.9	040	A8	7-9
PINE ISLAND SOUND	11	0145,0165,0260	-5.6	055	V11	10-12
		0270,0280,0285	-4.3	045	A9	8-10
		0290				
	12	0270,0290,0295	-5.3	055	V11	10-12
		0405,0406	-4.7	045	A9	8-10
	3a	0136,0140	-4.7	045	A9	7-9
MATLACHA PASS	4a	0140,0145,0252	-6.0	060	V12	10
		0260				
	9b	0160	-4.8	050	A10	8
	11a	0165,0170	-4.2	040	V8	10
			-3.7	035	A7	8-10
	11b	0280,0285	-5.9	060	V12	11
			-3.8	040	A8	8-11

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE IN FEET

³ROUNDED TO NEAREST FOOT

⁴DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED

⁵INCLUDES EFFECTS OF WAVE ACTION

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL

(UNINCORPORATED AREAS)

COASTAL FLOOD INSURANCE ZONE DATA

CHARLOTTE HARBOR — PINE ISLAND SOUND — MATLACHA PASS

FLOODING SOURCE	TRANSECT	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 10% (100 YEAR) FLOOD AND 1% (10 YEAR)	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (FEET NGVD)
SAN CARLOS BAY	12	0290,0295,0405 0406,0407	-5.3	055	V11	10-12
	13	0295,0325,0407 0426	-9.8	100	V20	15-18
			-6.4	065	A13	10-13
	14	0426,0427,0429	-9.1	090	V18	15-18
			-5.2	050	A10	12-14

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE IN FEET

³ROUNDED TO NEAREST FOOT

⁴DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED

⁵INCLUDES EFFECTS OF WAVE ACTION

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

COASTAL FLOOD INSURANCE ZONE DATA

SAN CARLOS BAY

FLOODING SOURCE	TRANSECT	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100 YEAR) FLOOD AND 10% (10 YEAR)	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ^{3,4} (FEET NGVD)
GULF OF MEXICO	15	0325,0350,0427 0429,0433,0435	-9.9	100	V20	15-19
			-6.1	060	A12	10-14
	16	0429	-9.9	100	V20	14-18
			-7.4	075	A15	12-14
	17	0433,0435,0441	-9.8	100	V20	14-19
			-6.7	065	A13	11-13
	18	0433,0435,0441 0442	-9.8	100	V20	14-18
			-7.4	075	A15	11-14
	19	0435,0441,0442 0444,0463,0465	-9.8	100	V20	15-17
			-7.6	075	A15	11-14
	20	0442,0444,0463 0465	-11.8	120	V22	15-19
			-7.5	075	A15	12-13
	21	0463,0501,0505	-9.8	100	V20	15-19
			-8.2	080	A16	13-14
	22	0501,0503,0505 0510	-10.1	100	V20	15-19
			-7.7	075	A15	11-14

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE IN FEET

³ROUNDED TO NEAREST FOOT

⁴DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED

⁵INCLUDES EFFECTS OF WAVE ACTION

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

COASTAL FLOOD INSURANCE ZONE DATA

GULF OF MEXICO

FLOODING SOURCE	TRANSECT	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1 0% (100 YEAR) FLOOD AND 10% (10 YEAR)	FLOOD HAZARD	ZONE	BASE FLOOD ELEVATION ^{3,4} (FEET NGVD)
GULF OF MEXICO	22A	0505,0510	-10.1 -6.1	100 060	V20 A12	15-19 13-15
	22B	0503,0505,0510	-10.1 -6.1	100 060	V20 A12	15-19 13-15
	22C	0505,0510	-9.3 -4.0	100 40	V20 A8	13-17 11-13
ESTERO BAY	19	0325,0350,0433 0435,0442,0455 0456	-10.9 -7.0	110 070	V21 A14	13 11-13
	20	0463,0465,0505	-11.9 -7.2	120 070	V22 A14	14 11-12
	21	0463,0465,0505 0510	-11.6 -7.9	120 080	V22 A16	14 12-13
	22	0505,0510	-11.2 -7.8	110 080	V21 A16	13 12-13
	22A	0505,0510	-9.9 -3.0	100 030	V20 A6	13 10-12
	22B	0503,0505,0510	-9.9 -3.0	100 030	V20 A6	13 10-12

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE IN FEET

³ROUNDED TO NEAREST FOOT

⁴DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED

⁵INCLUDES EFFECT OF WAVE ACTION

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

COASTAL FLOOD INSURANCE DATA

GULF OF MEXICO—ESTERO BAY

FLOODING SOURCE	TRANSECT	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 10% - 100 YEAR FLOOD AND 10% - 10 YEAR	FLOOD HAZARD	ZONE	BASE FLOOD ELEVATION ^{3,4} (FEET NGVD)
ESTERO BAY	22C	0505,0510	-9.9 -3.0	100 030	V20 A6	13 10-12
CALOOSAHATCHEE RIVER	23	0200,0225,0250 0295,0325,0350 0426,0427,0435	-3.5 -4.8	035 050	A7 A10	8 8-10

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE IN FEET

³ROUNDED TO NEAREST FOOT

⁴DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED

⁵INCLUDES EFFECT OF WAVE ACTION

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

COASTAL FLOOD INSURANCE DATA

ESTERO BAY—CALOOSAHATCHEE RIVER

Flood Insurance Studies for Charlotte, Hendry, and Collier Counties, Unincorporated Areas, Florida have been published (References 24, 25, and 26). The data in this Flood Insurance Study do not agree with the data in the adjacent counties because a modified storm surge model was used in this analysis.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 1375 Peachtree Street, N.E., Gulf Oil Building, Suite 664, Atlanta, Georgia 30309.

8.0 REFERENCES AND BIBLIOGRAPHY

1. South Florida Water Management District, Determination of 100-year Coastal Surge Flood Elevations for Lee County, Florida, with Appendices, January 1983.
2. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Florida, Washington, D.C., February 1982.
3. U.S. Army Corps of Engineers, Jacksonville District, Flood Plain Information, Charlotte and North Lee Counties, May 1968.
4. ———, Special Flood Hazard Information Report on South Lee County Coastal Areas, July 1970.
5. ———, Jacksonville District, Design Memorandum, Rainfall-Frequency Estimates, Partial Definite Projects Report, Central and Southern Florida Project for Flood Control and Other Purposes, Part VI, Section 6, September 1953.
6. U.S. Department of Commerce, U.S. Weather Bureau, Technical Paper No. 49, Two to Ten Day Precipitation for Return Periods of 2 to 100 Years in the Contiguous United States, 1964.
7. ———, Digitized Rainfall Data for Rainfall Station in Southern Florida, 1977.
8. ———, National Oceanic and Atmospheric Administration, National Weather Bureau, Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods From 1 to 100 Years, May 1961.
9. U.S. Water Resources Council, Bulletin 15, A Uniform Technique for Determining Flood Flow Frequencies, December 1967.
10. U.S. Department of Commerce, Environmental Science Services Administration, Technical Memorandum WBTM, Hydro 11, Joint Probability Method of Tide Frequency Analysis, V.A. Meyers, April 1970.

11. ———, National Oceanic and Atmospheric Administration, National Weather Service, Tropical Cyclone Deck 993, 1975.
12. ———, National Weather Service, Monthly Weather Review, Abstracts of Previous Year Hurricane Season, 1964 to 1977.
13. ———, Weather Bureau, Technical Paper No. 55, Tropical Cyclones of the North Atlantic Ocean 1871-1963, G.W. Cry, 1965.
14. ———, Technical Report NW5-15, Some Climatological Characteristics of Hurricanes and Tropical Storms, Gulf and East Coasts of the U.S., F.P. Ho, R.W. Schwerdt, and H.V. Goodyear, May 1975.
15. ———, National Hurricane Research Project, Report No. 5, Survey of Meteorological Factors Pertinent to Reduction of Loss of Life and Property in Hurricane Situations, March 1957.
16. Tetra Tech, Inc., Coastal Flooding Storm Surge Model, Part 1 - Methodology, Part 2 - User's Guide, Part 3 - Codes, Prepared for the Federal Emergency Management Agency, 1981.
17. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles Generalized Computer Program, Davis, California, November 1976.
18. Hamrick Aerial Surveys, Inc., Topographic-Aerial Photos of Lee County, Florida, Scale 1:300, Contour Interval 1 foot, February 1981, November 1981.
19. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 5 feet; Placida, Florida (1957), Photorevised (1972); Punta Gorda S.W., Florida (1957), Photorevised (1972); Punta Gorda S.E., Florida (1956), Photorevised (1972); Gilchrist, Florida (1957), Photorevised (1972); Tuckers Corner, Florida (1957); Telegraph Swamps, Florida (1956), Photorevised (1973); Port Boca Grande, Florida (1958), Photorevised (1972); Bokeelia, Florida (1958), Photorevised (1972); Matlacha, Florida (1958), Photorevised (1972); Fort Myers N.W., Florida (1958), Photorevised (1972); Fort Myers, Florida (1958), Photorevised (1972); Olga, Florida (1958), Photorevised (1973); Alva, Florida (1958), Photorevised (1973); Captiva, Florida (1958), Photorevised (1972); Pine Island Center, Florida (1958), Photorevised (1972); Fort Myers S.W., Florida (1958), Photorevised (1972); Fort Myers S.E., Florida (1958), Photorevised (1972); Alva S.E., Florida (1958), Photorevised (1973); Wulfert, Florida (1958), Photorevised (1972); Sanibel, Florida (1958), Photorevised (1972); Fort Myers Beach, Florida (1958), Photorevised (1972); Estero, Florida (1958), Photorevised (1972); Corkscrew N.W., Florida (1958), Photorevised (1973); Corkscrew, Florida (1958), Photorevised (1973); Bonita Springs, Florida (1958), Photorevised (1972); and, Corkscrew S.W., Florida (1958), Photorevised (1973).
20. National Academy of Sciences, Methodology for Calculating Wave Action Effects Associated with Storm Surges, 1977.

21. Federal Emergency Management Agency, Type 19 Flood Insurance Study, City of Sanibel, Lee County, Florida (in progress).
22. ———, Type 19 Flood Insurance Study, City of Cape Coral, Lee County, Florida (in progress).
23. ———, Type 19 Flood Insurance Study, City of Fort Myers, Lee County, Florida (in progress).
24. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Charlotte County, Unincorporated Areas, Florida, August 1977.
25. Federal Emergency Management Agency, Flood Insurance Study, Hendry County, Unincorporated Areas, Florida, May 1982.
26. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Collier County, Unincorporated Areas, Florida, September 1979.

9.0 REVISIONS DESCRIPTION

This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood hazard data located at the Division of Code Enforcement, Lee County, Florida.

9.1 First Revision (Revised November 3, 1989)

a. Acknowledgments

The WHAFIS analyses for this Revisions Description were performed by Tackney & Associates, Inc. The Federal Emergency Management Agency reviewed and accepted these data for purposes of this revision.

b. Scope

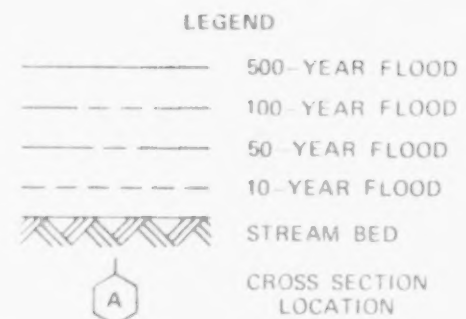
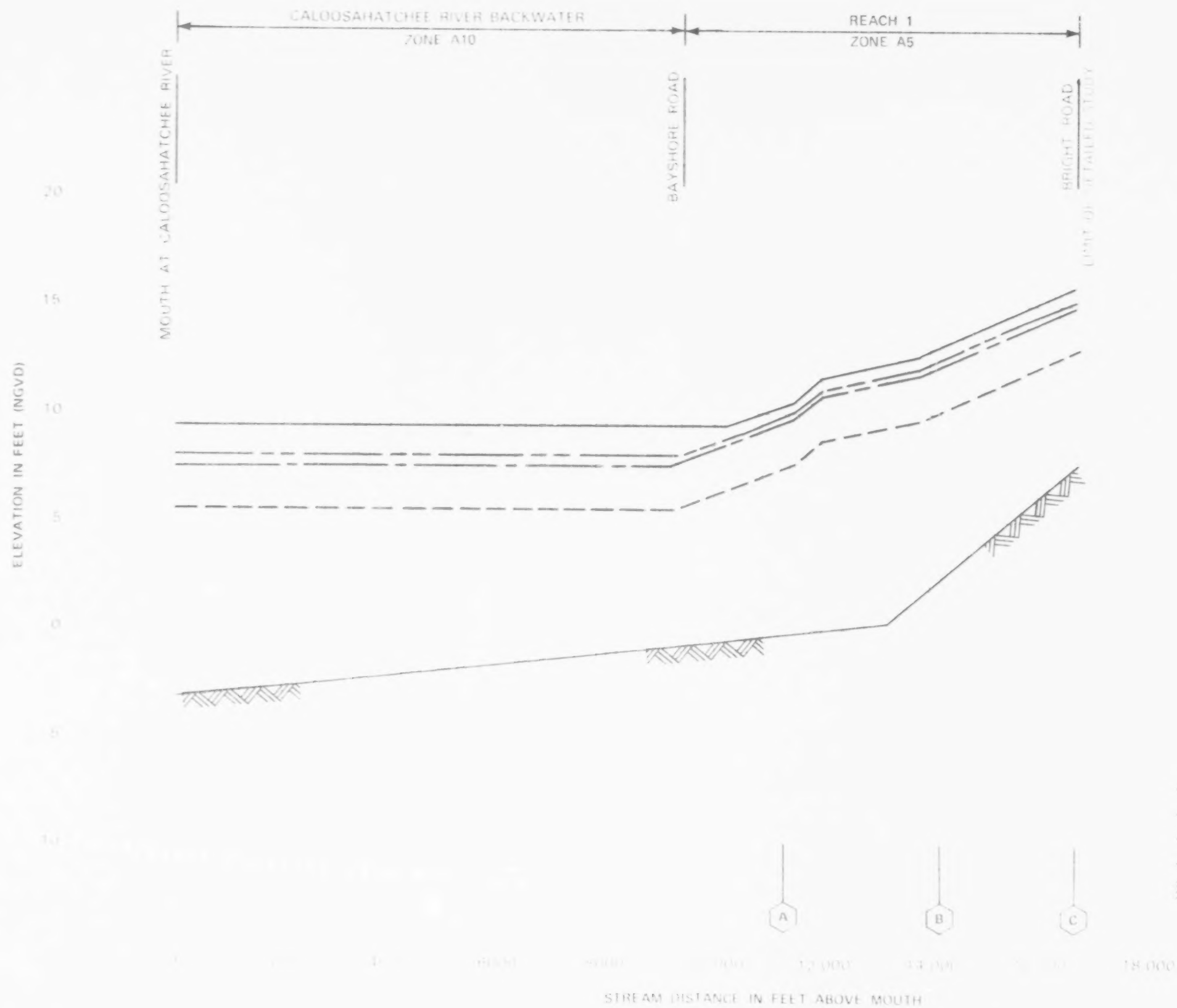
Based on better topographic and vegetation information, the wave height elevations for three additional transects along the Gulf of Mexico, south of transect 22, were computed using the WHAFIS computer model (Reference 27). The additional transects are shown on Figure 3, Transect Location Map, as transects 22A, 22B, and 22C, and are described in Table 4, Summary of Stillwater Elevations. Additionally, the zone designations and base flood elevations were changed as a result of a revised WHAFIS analyses and to agree with the Flood Insurance Rate Map for Collier County (Reference 28). The revised zone designations are shown in Table 7, Coastal Flood Insurance Zone Data.

c. Other Studies

The published Flood Insurance Study for Collier County, Florida (Reference 28) is in agreement with this revised study. This revision does not affect any other contiguous communities.

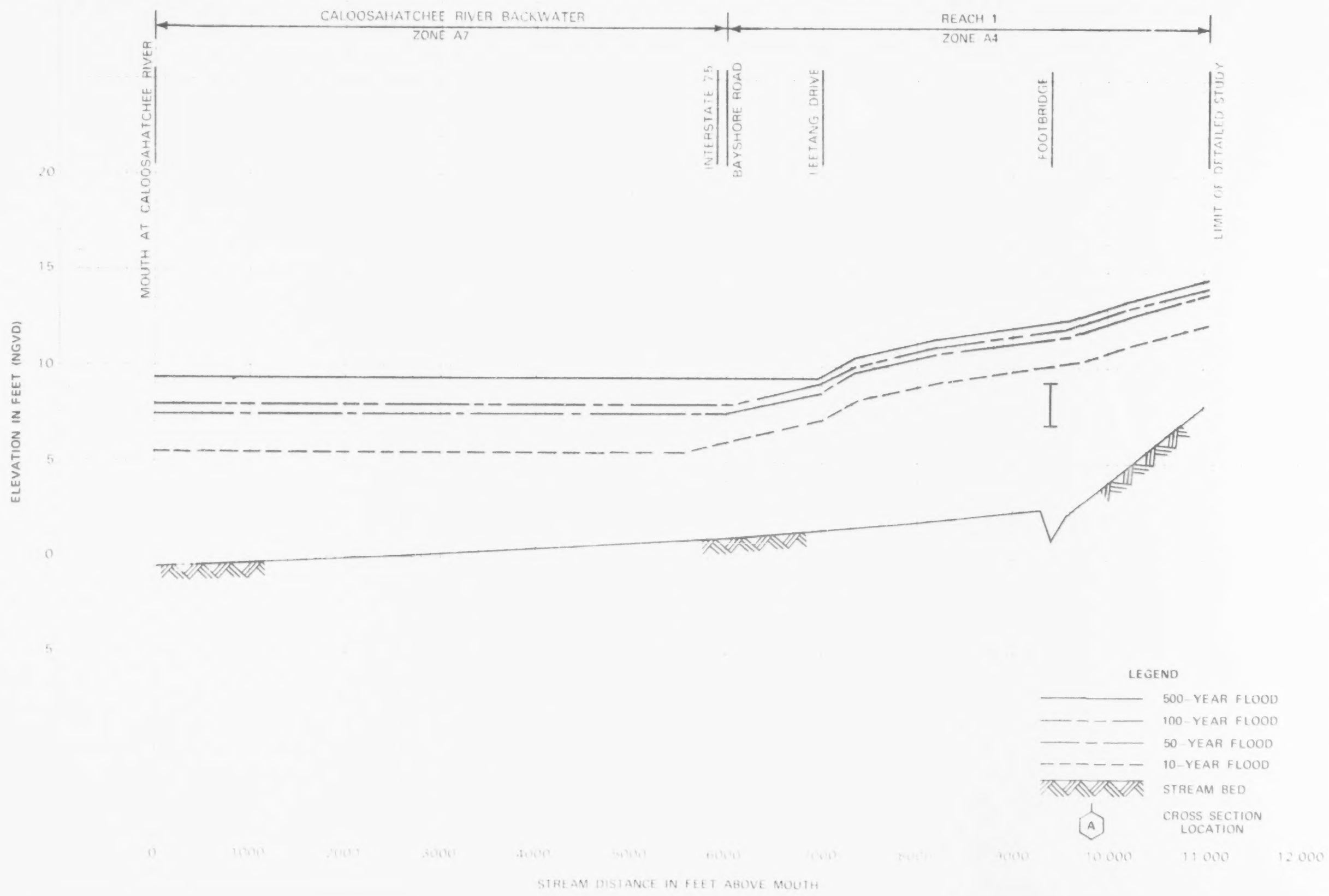
d. References and Bibliography

27. Federal Emergency Management Agency, Users Manual for Wave Height Analysis, revised February 1981.
28. -----, Flood Insurance Study, Collier County, Unincorporated Areas, Florida, June 1986.



FLOOD PROFILES
DAUGHTREY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
COUNTY OF LEE, FL
(UNINCORPORATED AREAS)



FLOOD PROFILES

POPASH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)



FLOOD PROFILES

STROUD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

05P

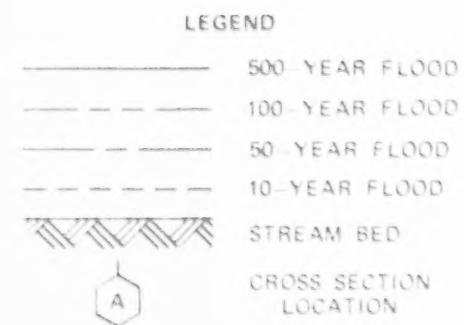
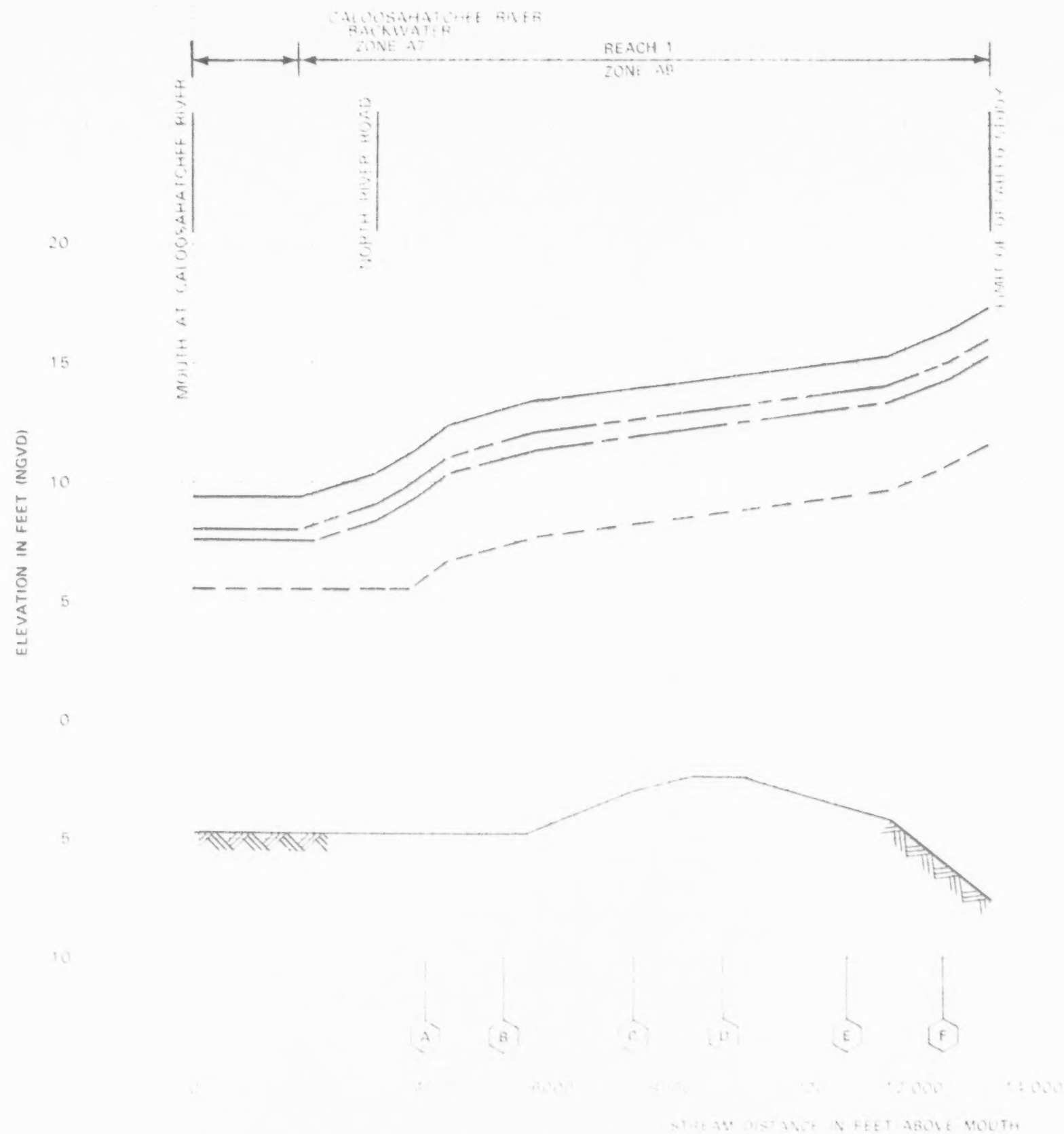


FLOOD PROFILES

OWL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

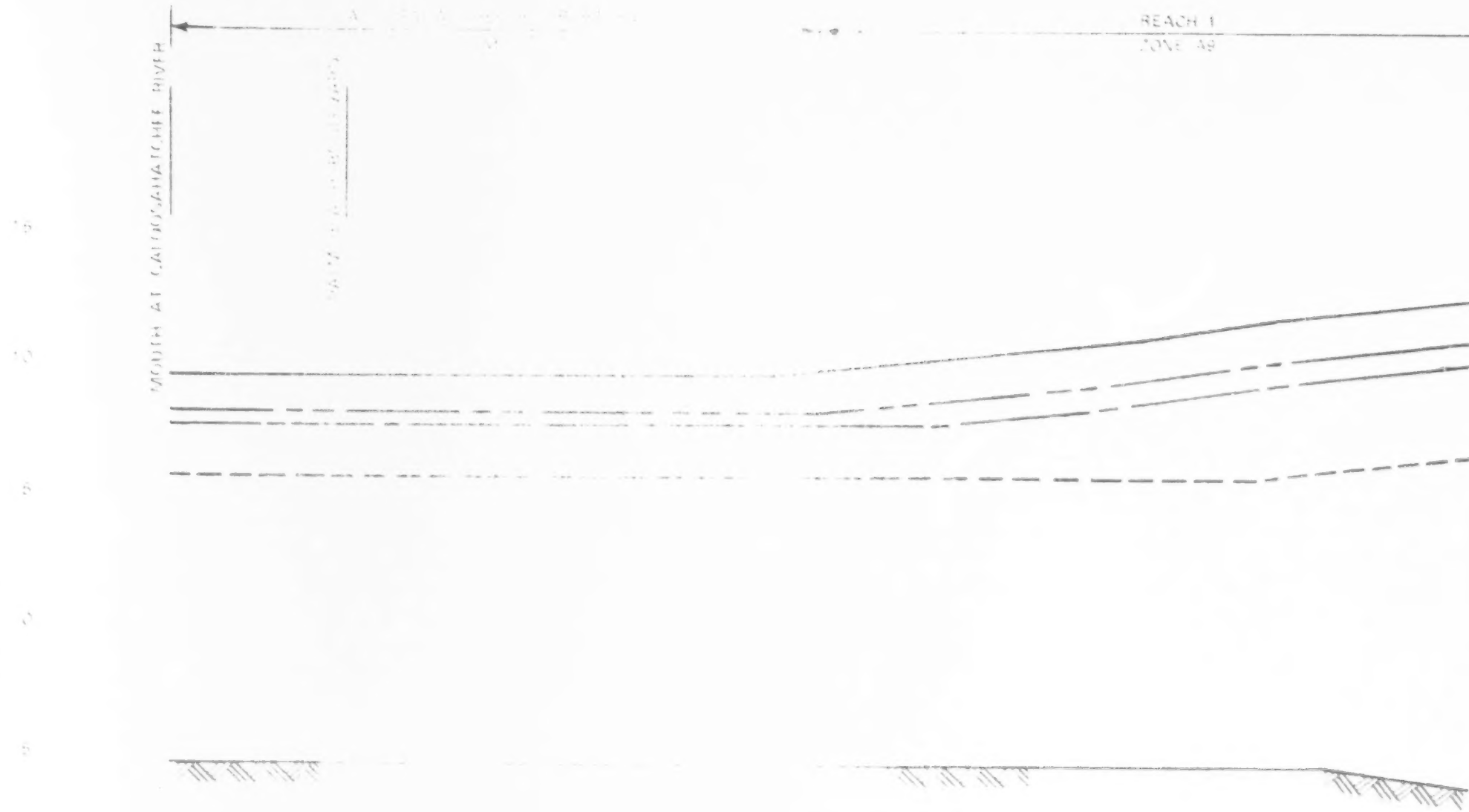
COUNTY OF LEE, FL
(UNINCORPORATED AREAS)



FLOOD PROFILES
TELEGRAPH CREEK

FLORIDA DEPARTMENT OF TRANSPORTATION
COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

ELEVATION IN FEET (NGVD)



FLOOD PROFILES

HICKEY CREEK

FLORIDA EMERGENCY MANAGEMENT AGENCY

COUNTY OF LEE, FL
(UNINCORPORATED AREAS)

08P

